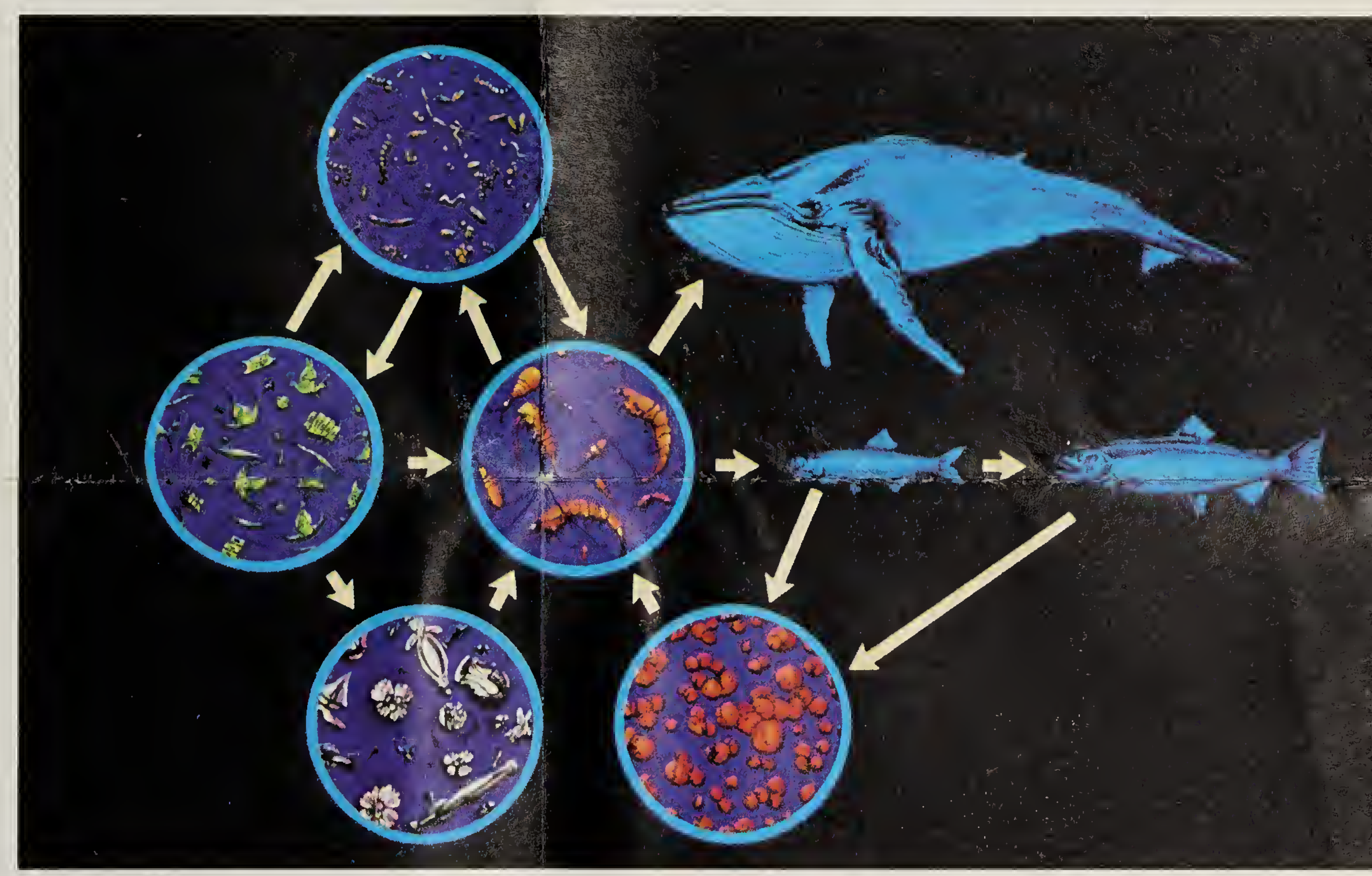
Existing in an almost endless variety of shapes and forms . . .

Plankton and the Open Sea (Second Edition)

A 16mm film or videocassette—22 minutes



Just below the surface water of the world's oceans and seas exist billions of tiny plants and animals called plankton—a floating life force that may yet prove to be one of our most important natural resources. This detailed film reviews the basic biology of plankton and discusses plankton's position in the ocean's ecosystem. It also shows ongoing efforts of researchers to achieve more effective management of this essential life form.

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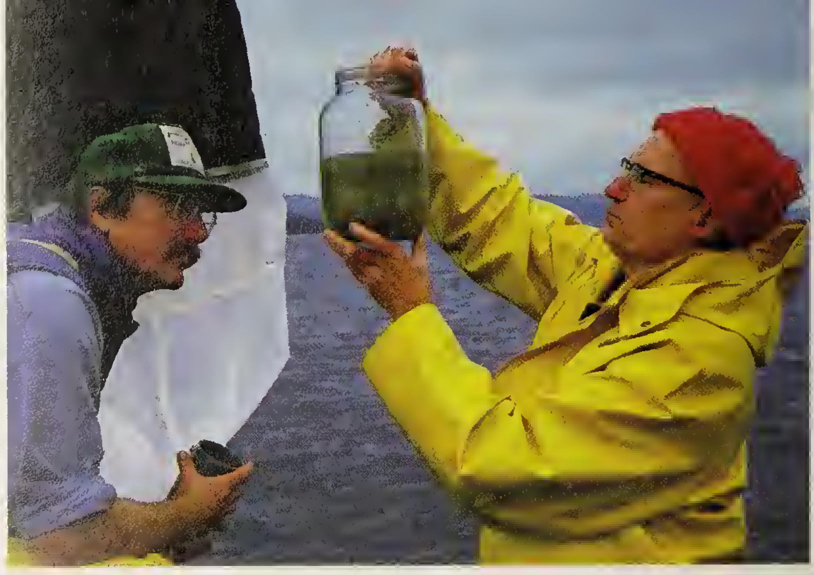
Plankton and the Open Sea

- Divides plankton into phytoplankton and zooplankton and describes the ecological relationship between the two divisions.
- Provides various examples of phytoplankton and discusses phytoplankton as the major photosynthesizing organism on earth.
- Provides various examples of zooplankton, both carnivorous and plant-eating.
- Shows the means by which scientists study plankton and discusses the importance of their research.



Summary of Content

The world's oceans abound with microscopic plants and animals called plankton. Examining plankton from different locations at different times of the year allows scientists to learn how they are distributed and how their numbers and types change with a change in season.

Study of the organisms requires a microscope. First seen is zooplankton—the animal form. Increased magnification shows phytoplankton—the smaller plant form. The microscope reveals an almost limitless array of shapes and forms.

Diatoms are the most abundant form of phytoplankton. Some are living cells encased in tiny, ornamented glass boxes; others are small colonies, clinging together in delicate patterns.

A second form of phytoplankton is the dinoflagellate, a mobile organism that propels itself by two whiplike flagellae. The still-small microflagellates use four flagellae to achieve their speed.

While phytoplankton don't look plantlike, they are in fact the major photosynthesizing organism on earth. Like all other plants, their cells contain chloroplasts, the green organelles of photosynthesis. Because light is essential in photosynthesis, plankton maintain themselves in the ocean's surface waters, different types achieving buoyancy through different means. The centric diatom is buoyant, for example, because of oil stored in its cell. The dinoflagellate makes itself buoyant by constantly replacing heavy materials in its cell with lighter ones. And some diatoms are covered with bristles and spines that reduce their sinking rate.

Both diatoms and dinoflagellates, the major organisms of phytoplankton, reproduce by fission, and, according to Dr. Benjamin Volcani, an expert on the biology of diatoms at the Scripps Institution of Oceanography, they are "the cornerstone of the food chain and the major supplier of oxygen to the earth."

Dr. Mark Huntley, also of Scripps, studies the ecological relationship between phytoplankton and the zooplankton that feed on them. The most important zooplankton are copepods, microcrustaceans that are the most abundant form of life on earth. Voracious eaters, copepods use the rotary beating of their forward appendages to create water currents that bring phytoplankton into their mouths. Copepods go through a series of larval stages before becoming adults and spend their whole lives as permanent members of the plankton group. Another such member is the larvacean, an invertebrate encased in a jellylike house.

Among the zooplankton is the tomopterid worm, a predator on other zooplankton. Others in the family include the arrowworm, the rotifer, the medusa (also known as jellyfish), and the tintinnid, which feeds on phytoplankton.

Not all zooplankton live in the oceans; many may be found in shallow waters. The sea star is one animal that uses shallow waters as breeding grounds. As the embryo is carried by tides and currents, sometimes hundreds of kilometers, it develops into a larva and, after several weeks, into an adult.

Thousands of marine animals spend part of their life as temporary plankton, among them the sea urchin larva. As it grows, its limestone skeleton becomes so heavy that the sea urchin sinks out of the plankton to the bottom of the water.

Many larvae do not resemble their adult forms, but some, like the young octopus, do. Additionally, not all temporary plankton are immature forms of invertebrates.

While phytoplankton live in the water's sunlit surface in a layer called the euphotic zone, zooplankton avoid light by living in the darkness of deep water. At dusk, they swim to the surface to feed on plant food, returning to the darkness before sunrise in a daily commute called vertical migration. The darkness in which they live is interrupted only by bursts of blue-green light called bioluminescence, a phenomenon made by the zooplankton themselves.

To study this phenomenon, scientists suspend a sensitive light meter from a hugh tripod positioned on the seafloor. Its readings are sent for analysis to a computer on shore.

Without plankton, almost no ocean creature could exist. At the bottom of the food chain, phytoplankton begin a flow of energy that eventually reaches larger animal life. The flow then connects with other, smaller food chains to create a food web.

Today, researchers are drawing on new technology in their ongoing studies of plankton. Ruth Wittenberg-Fay, Project Manager of the West Coast Fisheries Demonstration Program, shows that satellite technology provides a global view of plankton concentrations in the ocean that fishermen can use to locate productive areas.

In addition, and more important, such research provides information that scientists can use to manage ocean resources more efficiently. Monitoring the movement and status of plankton ensures the health of the world's oceans for the future.

For Discussion

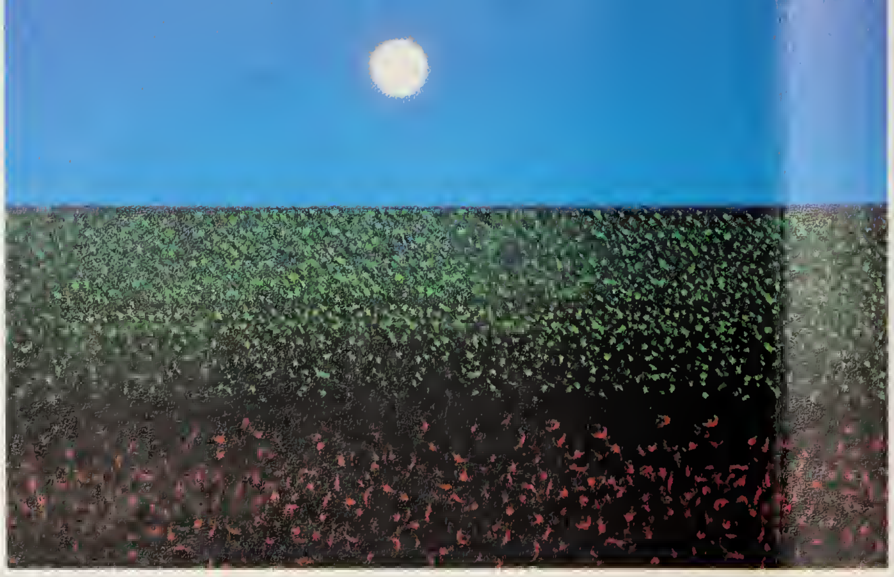
Before viewing

1. What are plankton? Find out how many students are aware of the role of plankton in the ocean's ecology.
2. Discuss food chains. Ask students to give examples of food chains in their immediate environments.
3. The following vocabulary is used in the narration of *Plankton and the Open Sea.*

arrowworm
bioluminescence
biosphere
carnivore
centric diatom
chloroplast
cilia
copepod
cyprid
diatom
dinoflagellate
ecology
embryo
euphotic zone
fission
flagellae
food chain
food web
kelp forest
larvacean
larva/ae
medusa
metamorphosis
microcrustacean
microflagellate
nauplius
organelle
organism
parapodia
photosynthesis
phytoplankton
polychaete worm
rotifer
sea urchin
sediment
slurry
tintinnid
tomopterid worm
translucent
vertical migration
zoea
zooplankton

After viewing:

1. What are the two principal divisions of plankton? How are they different?
2. Why do phytoplankton live near the ocean's surface? What is the name of the zone in which they are found? Give examples of ways in which various types of phytoplankton are able to maintain buoyancy.
3. Where do zooplankton maintain themselves? To what does the term "vertical migration" refer?
4. Define photosynthesis. Comment on this statement from the film: "Phytoplankton are the major photosynthesizing organism on earth, more prolific than all the forests and jungles combined."
5. Describe the appearance of a diatom. What happens to its shell when it dies? How do diatoms and dinoflagellates reproduce?
6. Discuss Dr. Volcani's statement in the film that diatoms and dinoflagellates are "the cornerstone of the food chain and the major supplier of oxygen to the earth."
7. What is the ecological relationship of phytoplankton and zooplankton? How does the copepod eat? What other examples of carnivorous zooplankton are mentioned in the film, and how do they eat?
8. What are some examples of temporary plankton? Describe how the sea star, for example, passes through a temporary planktonic phase. What are other examples of temporary plankton?
9. What is an example of temporary plankton that is not an immature form of an invertebrate?
10. What is the meaning of the term "bioluminescence"? Research more about what scientists hope to learn by studying this phenomenon.
11. What is the difference between a food chain and a food web? Discuss this statement from the film: "The dependence of the organisms in the marine food web means that a change to any one member could affect the whole web."



12. Contact marine biology research facilities or like institutions for information about the uses that scientists envision for plankton in the future.
13. Research other marine organism groups, such as nekton, benthos, and neuston. In what ways do they differ from plankton?
14. The film narration includes the following statement: "Each year, we utilize the resources of the sea a bit more, and so each year, we change the ocean a bit more." In what ways might our use of ocean resources endanger the plankton? How would our lives change if our use of the ocean upset the ocean's food chain?

In collaboration with

Dr. Mark Huntley
Scripps Institution of Oceanography
La Jolla, California

Dr. William V. Mayer
Biological Science Curriculum Study
Colorado Springs, Colorado

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